

RadWorks Project

ISS REM – to – BIRD – to – HERA:

The Evolution of a Technology

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HAT: 6.5.5.3

TA: 6 - Human Health, Life Support & Habitation Systems, 6.5.5 - Radiation; Monitoring Technology

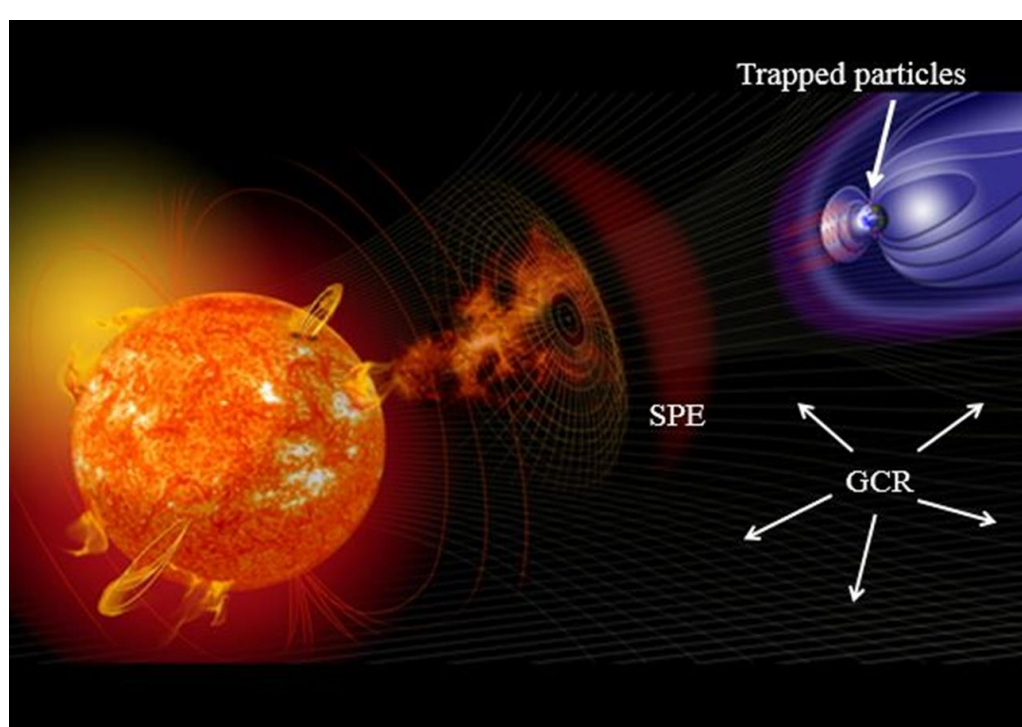
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OVERVIEW

The advancement of particle detectors based on technologies developed for use in high-energy physics applications has enabled the development of a completely new generation of compact low-power active dosimeters and area monitors for use in space radiation environments. One such device, the TimePix, is being developed at CERN, and is providing the technology basis for the most recent line of radiation detection devices being developed by the NASA AES RadWorks project. The most fundamental of these devices, an ISS-Radiation Environment Monitor (REM), is installed as a USB device on ISS where it is monitoring the radiation environment on a perpetual basis. The second generation of this TimePix technology, the BIRD (Battery-operated Independent Radiation Detector), was flown on the NASA EFT-1 flight in December 2014. Data collected by BIRD was the first data made available from the Trapped Belt region of the Earth's atmosphere in over 40 years. The 3rd generation of this technology, the HERA (Hybrid Electronic Radiation Assessor), is planned to be integrated into the Orion EM-1, and EM-2 vehicles where it will monitor the radiation environment. For the EM-2 flight, HERA will provide Caution and Warning notification for SPEs as well as real time dose measurements for crew members. The development of this line of radiation detectors provide much greater information and characterization of charged particles in the space radiation environment than has been collected in the past, and in the process provide greater information to inform crew members of radiation related risks, while being very power and mass efficient.

INNOVATION

The ability to provide near-real-time radiation risk assessment information for crewed missions is critical to crew health and safety and mission planning for all crewed missions, both for LEO and deep space destinations.



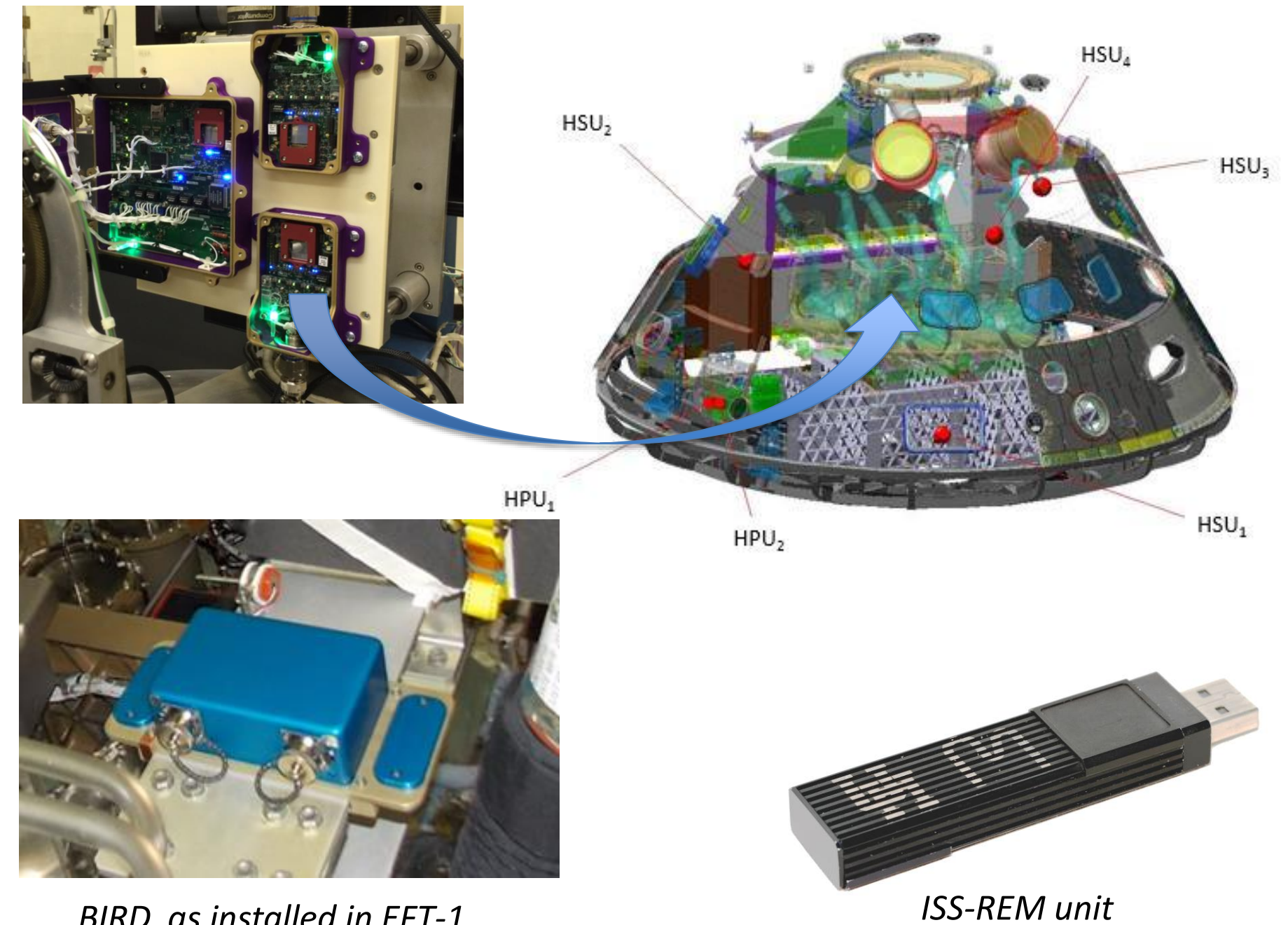
OUTCOME

Currently flying 6 ISS REM units

EFT-1 BIRD flown December 2014

Completion of Critical Design Review (HERA) January 2016

Delivery of flight hardware to KSC Fall 2016



BIRD, as installed in EFT-1

ISS-REM unit

INFUSION

All crewed space craft and surface operations in both LEO and deep space.

PAPERS / PRESENTATIONS

Stoffle, N., et al., Timepix-based radiation environment monitor measurements aboard the International Space Station, Nuclear Instrumentation Methods A.

Kroupa, M., et al., A Semiconductor Radiation Imaging Pixel Detector for Space Radiation Dosimetry.

Bahadori, A. A., et al., Battery-operated Independent Radiation Detector Data Report from Exploration Flight Test 1. NASA/TP-2015-218575.

"Space Radiation Dosimetric Applications Using Hybrid Pixel Radiation Imaging Detectors (e.g. Medipix)," Mini-Micro-Nano-Dosimetry Workshop, Port Douglas, Queensland, Australia.

"Past Results and Future Plans for Medipix Detectors in Space," Invited Seminar-Physics Department, University of Wollongong, Wollongong, NSW, Australia.

PARTNERSHIPS / COLLABORATIONS

The RadWorks team is working with the ISS community for the flight/resupply of ISS-REM units on orbit. The NASA/BIRD element worked with NASA and Lockheed Martin for the development and integration of the BIRD in the EFT-1 flight. The RadWorks/HERA element is currently working with NASA Orion and their prime contractor, Lockheed Martin for integration of the HERA system into the EM-1 and EM-2 vehicles. In addition, NASA is collaborating with the University of Houston and the Medipix Collaboration out of CERN for utilization and advancement of the Timepix radiation sensor technology being utilized.